



United States Department of the Interior

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(FWS Reference: 1-3-00-F-1381)

Dear Colonel Rigsby:

Graves

This document transmits the Fish and Wildlife Service's (USFWS) biological opinion for the Howard Hanson Additional Water Storage Project proposed by the Corps of Engineers (Corps). The project site is located in King County, Washington. The biological opinion addresses effects on bull trout in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

This biological opinion is based on information provided in the Corps' final feasibility study report and final environmental impact statement for the additional water project (Corps 1998), the April 2000 programmatic biological assessment (Corps 2000), and on supplemental information provided Messrs. Ken Brunner and Fred Goetz of the Corps. A complete administrative record of this consultation is on file at this office.

CONSULTATION HISTORY

On January 28, 1998, the USFWS concurred with the Corps' not likely to adversely affect determination for the bald eagle (*Haliaeetus leucocephalus*), northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus marmoratus*), gray wolf (*Canis lupus*) and grizzly bear (*Ursus arctos*), in response to the Corps' January 1998 biological assessment. In April of this year, we received the Corps' "Programmatic biological assessment for continued operation and maintenance and phase 1 of the additional water storage project" (PBA). The PBA again addressed these listed species in addition to the Coastal/Puget Sound bull trout (*Salvelinus confluentus*) and the Canada lynx (*Lynx canadensis*), which were listed as threatened on November 1, 1999, and March 24, 2000, respectively. The PBA included descriptions and effect determinations on four separate actions on which the Corps was

requesting the USFWS' review and concurrence. We notified the Corps on April 26, 2000, that we would consult only on the Corps' recommended action. Following several discussions by phone during the first two weeks in May, the Corps submitted a letter dated May 17, 2000, modifying the PBA to a single project action and effect determination. By June 15, 2000, we notified the Corps that while we concurred with the Corps' not likely to adversely affect determination for the bald eagle, northern spotted owl, marbled murrelet, gray wolf and grizzly bear, and Canada lynx, we did not concur with the Corps' not likely to adversely affect determination for the bull trout. On July 10, 2000, the Corps requested formal consultation on the continued operation of Howard Hanson Dam and Reservoir, and the Additional Water Storage Project (AWSP) with conservation measures.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Corps' continued operation and maintenance of Howard Hanson Dam and Reservoir, and Phase 1 of the Howard Hanson Additional Water Storage Project are being addressed in this biological opinion (BO). Any reference to the Additional Water Storage Project in this BO is limited to Phase 1, unless otherwise stated.

Continued Operations and Maintenance of Howard Hanson Dam and Reservoir

Howard Hanson Dam (HHD) was completed in 1962 by the Corps to provide downstream flood protection and augment flows in the lower Green River. The project is located in southeastern King County, approximately 45 miles from Seattle, Washington (Figure 2-1). The dam is located at River Mile (RM) 64.5 in Section 28, Township 21 North, Range 8 East, Willamette Meridian. The project site lies within the City of Tacoma (Tacoma) municipal watershed and access to much of the over 220 square miles of watershed above HHD is closed to the public. From RM 64.5, the Green River flows west and north from the Cascade Mountains to join with the Black River to form the Duwamish River. The Duwamish River then empties into Puget Sound 12 miles downstream at Elliott Bay.

HHD is currently operated to provide winter and spring flood control and summer low-flow augmentation for fish resources. Flood control operations are managed so that the dam release combined with downstream inflow doesn't exceed 12,000 cubic feet per second (cfs) at the Auburn U.S. Geological Survey (USGS) gage at RM 32. The dam has storage for 106,000 acre feet (ac-ft).

Winter operation is determined by flood control requirements. During the spring, the project switches to its secondary purpose of conservation storage for low-flow augmentation. The existing reservoir provides for 25,400 ac-ft of summer/fall storage; 24,200 ac-ft is active conservation storage available for enhancing instream flows below the project. During the switch from flood control to conservation storage the amount of water released from HHD is

reduced below the level of inflows, allowing the reservoir to refill. Refill timing and release rates are based on target instream flows that are adjusted yearly in response to the existing weather conditions, snowpack, amount of forecasted precipitation, and input on biological conditions from agency and tribal resource managers (Corps 1998).

The Corps has completed a Section 1135 Project which authorizes an additional 5,000 ac-ft of summer storage at HHD during selected years (e.g., initially during drought conditions expected in one out of five years) for a total active storage volume of 29,200 ac-ft. The project adds incremental habitat benefits by increasing the water supply available to augment low summer flows in the lower Green River. The adaptive management provisions of the Section 1135 project allow the additional storage frequency to be increased on an annual basis if shown to be beneficial to natural resources.

Additional Water Storage Project

The proposed action under the AWSP consists of the annual storage of up to 20,000 acre-feet of water for Tacoma's municipal and industrial water supply, the storage of up to 5,000 acre-feet of water for instream flow augmentation, the implementation of an adaptive management approach for the storage and release of water to benefit the fishery resources, the construction of downstream fish passage facilities at Howard Hanson Dam, and the implementation of a variety of habitat improvement measures, such as large woody debris and spawning gravel supplementation, side channel reconnection, plantings of emergent vegetation within the higher conservation zone, and the replacement of culverts.

Storage for Tacoma's Municipal and Industrial Water Supply

Up to 20,000 acre-feet of municipal and industrial water would be stored in the spring at a rate of up to 100 cubic feet per second for Tacoma's use during the summer and fall. The water surface elevation of the HHD pool would be raised by about 20 feet (from elevation 1,147 feet to 1,167 feet, mean sea level).

Flow Augmentation

Presently, 25,400 acre-feet of water is stored annually for instream flow augmentation purposes. In low flow years, an additional 5,000 acre-feet can be stored for flow augmentation purposes. Under the proposed action, the option to store the additional 5,000 acre-feet would be available in all water years. The storage of the additional 5,000 acre-feet for flow augmentation would raise the conservation pool by about 5 feet.

Adaptive Management of Water Storage and Release

Since 1962, the operation of Howard Hanson Dam has undergone a number of improvements to minimize the impact on the downstream fishery resources. Starting in the 1980's with the

planting of juvenile anadromous fish above HHD, operational changes were made to address upper basin fishery issues, i.e., delaying the refill of the reservoir to facilitate downstream fish passage through the reservoir. Under the proposed action, project operation will be adaptively managed to meet springtime reservoir refill objectives while providing dam releases that mimic natural flow variation. Specific objectives include:

- Initiate efforts to re-establish runs of historical upper Green River anadromous fish stocks;
- Maximize the survival of pre-smolts and smolts migrating through HHD and reservoir;
- Maximize attraction and passage of outmigrating salmonids (fry, pre-smolts, smolts and steelhead kelts) with a surface-intake downstream fish passage facility at HHD;
- Evaluate benefits and potential risks of artificial freshets to downstream fisheries resources;
- Establish flow management guidelines to optimize use of stored low-flow augmentation for downstream fishery benefits; and
- Evaluate AWSP refill effects on lower Green River anadromous salmonid fish stocks through inventory and monitoring.

Downstream Fish Passage Facility

The proposed action consists of the construction of a downstream fish passage facility at HHD. The main components include a new intake tower with a new fish collection and transport facility, consisting of a wet-well, a floating fish collector, a fish lock, a discharge conduit, a fish transport pipeline and monitoring equipment. Upstream fish passage past Tacoma's diversion dam and HHD will be provided by a trap-and-haul facility and operation that Tacoma will fund as part of its settlement agreement with the Muckleshoot Indian Tribe.

Habitat Restoration

Four riparian projects were selected to mitigate the impacts to the 120 acres of riparian habitat that will be inundated by the pool raise. These projects include maintenance of stream-corridor habitat within the inundation pool (13.3 acres) and management of riparian forests to accelerate succession on major streams above the project (108.3 acres) for a total of 121.6 acres. Project types include: leaving trees in the inundation pool rather than clearing (not counted as a listed project); planting of water-tolerant vegetation; reserving riparian forests; and intensified forest management, i.e., thinning and planting, to benefit wildlife species..

Nine tributary or stream projects were selected to mitigate for 17.4 acres of stream habitat area

inundated by the pool raise. These projects include maintenance of in-stream habitat within the inundation pool (8.1 acres) and improvement of habitat in streams above the project (8.8 acres) for a total of 16.9 acres. These projects do not equal the total 17.4 acre mitigation requirement, but additional compensation can be found by leaving trees in the inundation zone or under the two habitat restoration projects above and below the project. Stream habitat mitigation project types include: placement of large structures (boulders or logs) to increase habitat complexity; replacement of culverts reconnecting tributary habitat; creation of side-channel or pond habitat through excavation. The stream habitat mitigation will also be combined with 11.2 acres of improvements.

For the purpose of enhancing fish habitat, two sub-impoundments would be created near the 1,160-1,165 ft elevations in flood plain areas where the mainstem Green River enters the reservoir. In addition, several sub-impoundments will be created just by raising the pool and by overtopping the abandoned railroad grade. Culverts or water control structures will be placed in the grade to prevent juvenile fish stranding in these non-engineered impoundments.

Water tolerant vegetation will be planted along streams and along the upper margin of the reservoir inundation zone to improve habitat for fish and wildlife. About 115 acres of land will be planted with sedges, shrubs and/or trees.

Standing timber within the new inundation zone (between elevations 1,147 feet to 1,167 feet, mean sea level) will be retained to partially maintain wildlife, riparian and instream habitat values.

Gravel nourishment will be used to replenish areas presently deficient of suitable substrate for spawning by bull trout and other salmonids, and slow or stop the downstream extent of streambed armoring. To implement this measure, monitoring and/or sediment transport modeling will be conducted to evaluate the long-term impacts of this restoration measure. Under the continued operations and maintenance of HHD and the AWSP, 8,000 cubic yards of gravel are proposed for placement in the vicinity of Flaming Geysers State Park or at an upstream location near Palmer. Based on estimates presented in the AWSP feasibility report and environmental impact statement, HHD annually blocks about 13,400 cubic yards of gravel. An additional 4,000 cubic yards of spawning gravel is proposed for placement under the Corps' Duwamish/Green River Basin General Investigation authority for five years; after this, HHD Operations and Maintenance would continue nourishment for project years, 6-50.

In addition to gravel nourishment, two habitat restoration projects were selected to address original impacts of dam construction and pool inundation that impacted over 8 miles of stream and side-channel habitat. One project is a side-channel reconnection in the Upper Green River (below HHD) that will restore up to 3.2 acres of off-channel habitat and the other is 3.5 miles of river and stream habitat improvement in tributaries above the inundation pool (from 1,177 to 1,240 ft elevation). These projects will interact with the fish passage restoration facility and

should help facilitate the re-establishment of Headwaters and Upper Green River salmonid stocks.

One side channel restoration project (Signani Side Channel) is included in the proposed action, and involves habitat improvements and the reconnection of this side channel with the Green River mainstem.

Conservation Measures

In order to minimize the effects of the proposed action, several conservation measures will be implemented. These include:

1. The continued operation of HHD will be conducted in a manner that more closely mimics natural flow variations. The Corps will monitor the effects of its operation on downstream flows.
2. The Corps will place an average of 8,000 cubic yards of gravel downstream of HHD on an annual basis to replace a portion of the quantity of gravel-sized sediment estimated to be blocked by HHD. Of this total, 4,100 and 3,900 cubic yards would be placed as part of the Corps' continued operations and maintenance responsibilities and as an element of the AWSP, respectively. The Corps will monitor the effects of the gravel nourishment program.
3. A woody debris management program will be implemented to restore the downstream transport of wood past HHD. At least 50 percent of the wood collected from the reservoir each year will be passed downstream. The effects of the large woody debris program will be evaluated for the first fifteen years following its initiation.

STATUS OF THE SPECIES (rangewide and/or recovery unit)

The USFWS listed the Columbia River and Klamath Basin Distinct Population Segments (DPSs) of bull trout as threatened under the Act on June 10, 1998 (USDI 1998a; 63 FR 31647). The Coastal/Puget Sound and St. Mary-Belly River DPSs of bull trout were listed as threatened under the Act on November 1, 1999 (USDI 1999; 64 FR 58910). This rule combined all DPSs of bull trout in the conterminous United States, and declared them all as threatened. Declining trends and associated habitat loss and fragmentation have been documented range wide and several local extirpations have been reported (Bond 1992; Thomas 1992; Rieman and McIntyre 1993; Donald and Alger 1993; Washington Department of Fish and Wildlife 1997a).

Bull trout are a member of the char family and are related to Dolly Varden trout (*Salvelinus malma*). Bull trout are sympatric with Dolly Varden over part of their range, most notably in British Columbia and the Coastal/Puget Sound region of Washington State. Two distinct life history forms, migratory (fluvial or adfluvial) and resident, exist throughout the range of the bull trout (Rieman and McIntyre 1993). Bull trout are generally not anadromous (Meehan and Bjornn

1991), although anadromy may have been important in the past (Bond 1992) and is currently known to occur in Puget Sound and coastal rivers (Kraemer 1994; Mongillo 1993).

The historic range of the bull trout spanned seven states (Alaska, Montana, Idaho, Washington, Oregon, Nevada, and California) and two Canadian Provinces (British Columbia and Alberta) along the Rocky Mountain and Cascade Mountain ranges (Cavender 1978). In the United States, bull trout occur in rivers and tributaries throughout the Columbia Basin in Montana, Idaho, Washington, Oregon, and Nevada, as well as the Klamath Basin in Oregon, and several cross-boundary drainages in extreme southeast Alaska. In California, bull trout were historically found in only the McCloud River, which represented the southernmost extension of the species' range. Bull trout numbers steadily declined after completion of McCloud and Shasta Dams (Rode 1990). The last confirmed report of a bull trout in the McCloud River was in 1975, and the original population is now considered to be extirpated (Rode 1990).

Bull trout distribution has been reduced by an estimated 40 to 60 percent since pre-settlement times, due primarily to local extirpations, habitat degradation, and isolating factors. The remaining distribution of bull trout is highly fragmented. Resident bull trout presently exist as isolated remnant populations in the headwaters of rivers that once supported larger, more fecund migratory forms. These remnant populations have a low likelihood of persistence (Reiman and McIntyre 1993). Many populations and life history forms of bull trout have been extirpated entirely.

Highly migratory, fluvial populations have been eliminated from the largest, most productive river systems across the range. Stream habitat alterations restricting or eliminating bull trout include obstructions to migration, degradation of water quality (especially increasing temperatures and increased amounts of fine sediments), alteration of natural stream flow patterns, and structural modification of stream habitat (such as channelization or removal of cover).

Resident populations are generally found in small headwater streams where they spend their entire lives, whereas migratory populations rear in tributary streams for several years before migrating downstream into a larger river or lake to mature (Reiman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins and pools with suitable cover (Sexauer and James 1997).

Bull trout become sexually mature from 4 to 9 years old (Shepard *et al.* 1984). They spawn in the fall (August through October) (Shepard *et al.* 1984; Reiman and McIntyre 1996), typically in cold, low-gradient 1st- to 5th-order tributary streams, over loosely compacted gravel and cobble having groundwater inflow (Shepard *et al.* 1984; Brown 1992; Reiman and McIntyre 1996; Swanberg 1997; MBTSG 1998). Spawning sites usually occur near cover (Brown 1992). Migratory bull trout frequently begin spawning migrations as early as May and have been known to move upstream as far as 259 kilometers (155 miles) to spawning grounds (Fraley and Shepard 1989). Bull trout spawn in consecutive or alternate years (Shepard *et al.* 1984; Pratt 1992) and

may live more than 13 years. Post-spawning mortality, longevity, and repeat-spawning frequency are not well known (Rieman and McIntyre 1996).

Rieman and McIntyre (1993) state that bull trout appear to have more specific habitat requirements than other salmonids. In general, bull trout need habitat providing cold water, complex cover, stable substrate with a low percentage of fine sediments, high channel stability, and stream/population connectivity. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre (1993)), they should not be expected to simultaneously occupy all available habitats (Rieman *et al.* 1997).

Rieman and McIntyre (1993) state that water temperature is consistently recognized by researchers more than any other factor as influencing bull trout distribution. Distribution of adults is thought to be limited by temperatures above 15°C, while optimum incubation and juvenile rearing temperatures are thought to be much lower, 2 to 4°C and 4 to 8°C, respectively (Goetz 1989; Pratt 1992). Water temperature seems to be an important factor in determining survival in the early life history of juvenile bull trout, with cool water temperatures resulting in higher egg survival and faster growth rates for fry and juveniles (Pratt 1992).

Sedimentation is shown to cause negative effects on bull trout, although no thresholds can be set as clear tolerance limits for population maintenance (Rieman and McIntyre 1993). Emergence success of fry appears to be affected by the proportion of sediment in the substrate (Pratt 1992). Rearing densities of juvenile bull trout have been shown to be lower when there are higher percentages of fine sediment in the substrate (Shepard *et al.* 1984). Young bull trout are closely associated with the stream bed, this association appearing more important to bull trout than for other species (Pratt 1992; Rieman and McIntyre 1993). Due to this close connection to substrate, bed load movements and channel instability can also negatively influence the survival of young bull trout.

Bull trout distribution and abundance is positively correlated with complex forms of cover and with pools (Rieman and McIntyre 1993). Cover with which bull trout are usually associated consists of large or complex woody debris and undercut banks, but may also include coarse substrates (cobble and boulder). Studies conducted with closely related Dolly Varden showed that population density declined with the loss of woody debris after clearcutting or the removal of logging debris from streams (Bryant 1983; Dolloff 1986; Elliott 1986; Murphy *et al.* 1986).

The marine and estuarine residency period for bull trout is poorly understood. The lack of data requires using literature for other species, like Dolly Varden and cutthroat trout. Aitkin (1999) reviewed the estuarine habitat of anadromous salmon, including native char. His literature review found that Dolly Varden pass through estuaries while migrating, like steelhead, and inhabit coastal neritic waters, like cutthroat trout. Cutthroat trout that reside in estuaries are opportunistic and prey upon small fish like outmigrating salmonid fry. Kraemer (1994) found that the distribution of native char in marine waters was also closely timed to the distribution of bait fish, especially their spawning beaches. Char from Puget Sound have been found to prey on

surf smelt, Pacific herring, Pacific sand lance, pink, chum and chinook salmon smolts, and a number of invertebrates (Kraemer 1994, Footen 2000). The Quinault Nation (1995) documented smelt as a prey item for native char in the Queets River.

ENVIRONMENTAL BASELINE (in the action area)

Very limited information is available on the status of bull trout in the Green River drainage. Bull trout are presumed to occur in very low numbers in this system, but no spawning locations are known (WDFW 1997). The life history forms of bull trout in this drainage are not known. Historical accounts suggests that bull trout were once common (Suckley and Cooper 1860). However, creel counts on the Green River, dating from 1940, indicate bull trout are now extremely rare, with only four char taken by over 35,500 anglers checked between 1940 and 1973 (T. Cropp, WDW, in litt. 1993). Sports anglers caught four adult char at the Northwind Weir (Tukwila), in April, 1978 (Moore 1999). Though few in number, Cropp (WDW, in litt. 1993) indicated that char are still occasionally caught in the Green River. A native char was caught in May 1994 in the Duwamish River that was positively identified as a bull trout both by Haas measurements and by genetic analysis (Warner 1997). Watson and Toth (1994, in WDFW 1997) state that native char have been harvested in the Green River as far upstream as river mile 64. In February 2000, a bull trout, as determined by Haas measurements, was caught in the Green River near the mouth of Newaukum Creek (Warner 2000). More recently, two native char were captured in beach seines in the Duwamish Estuary on August 10, 2000 (Mavros 2000). Tissue samples were taken, but the results of the genetic tests are not yet available. Plum Creek has conducted presence/absence surveys for bull trout in the upper Green River watershed above Howard Hanson dam, with no presence documented. The USFWS conducted surveys of char in tributaries to Howard Hanson Reservoir and found eastern brook trout in Page Mill Pond. No other char were found in any of the tributaries entering the reservoir (Wunderlich and Toal 1992).

Mongillo (1993) listed bull trout in the Green River as a remnant population, with status unknown, and with an immediate need for data. WDFW (1997) lists the Green River population as unknown status. The Fish and Wildlife Service believes the status of this subpopulation is depressed, based on available information that indicates native char occur in very low numbers in comparison to historic levels. Total abundance for the subpopulation is believed to be less than 5,000 individuals or 500 adults.

Since extensive surveys specifically for bull trout have not been conducted, and at least one bull trout was recently found 40 miles upstream from the mouth of the Green/Duwamish River, the USFWS assumes that bull trout use the Green River and/or its tributaries for foraging, rearing, spawning and migration for the purpose of this BO.

The Green River and its tributaries presently provide only poor to fair habitat for bull trout because of industrial, residential and agricultural developments along the lower and middle reaches of the Green River, the presence of two dams at river mile 61 and 64.5, and extensive

timber harvest in the upper basin. These activities have resulted in the increase in fine sediments, a severe reduction in the riparian corridor, constriction of the river channel and isolation from its flood plain, a reduction in channel complexity and habitat diversity, instream flow reductions, alteration of the natural flow regime, elevated water temperatures, the interruption of the transport of large woody debris and spawning gravels, and the blockage of access to upstream habitats.

Bull trout spawning habitat is limited by the availability of suitable substrate and water temperatures. The Green River channel below HHD and extending downstream to near Flaming Geysers Park is largely armored due to the interception of coarse sediments by HHD (Perkins 1999). A large landslide near Flaming Geysers State Park and several tributaries, including Soos, Newaukum and Burns Creeks, contributes large amounts of fine sediment. Most of the tributary streams are also impacted by sedimentation. The temperature of the water released from HHD may be too high for successful bull trout spawning and incubation in the Green River downstream from HHD, but springs entering the channel bed may provide suitable conditions. Some of the spring fed tributaries, both upstream and downstream of HHD, may also provide suitable spawning and incubation habitat.

Bull trout rearing habitat is likely limited by high water temperatures and the relative lack of channel complexity and habitat diversity. The removal of riparian vegetation and large woody debris from the system, the confinement of the channel by levees and riprap, the elimination of the channel forming flood flows, water withdrawals, and reduced groundwater recharge have all contributed to degradation of bull trout rearing habitat. As a consequence, the Green River mainstem probably provides suitable rearing habitat for only a portion of the year, with spring fed tributaries providing summertime refuge.

The Green River and many of its tributaries provide suitable foraging habitat for bull trout, given the significant number of chinook, coho and chum salmon, and steelhead trout that are produced within the basin. Other potential prey resources include sculpins, suckers, whitefish, and crayfish, as well as a number of estuarine and marine species within the tidally influenced portion of the lower river.

Habitat Conservation Plans (rangewide)

The range-wide status of the bull trout has been affected by a number of recent Habitat Conservation Plans (HCPs) that were prepared in conjunction with incidental take permit applications to the USFWS pursuant to section 10(a)(1)(B) of the Act.

Two HCPs have been amended to include the bull trout in Washington State, although others were written for aquatic species. The two amendments were for the Plum Creek Timber Company and the Washington Department of Natural Resources HCPs. In addition, Tacoma Water is presently preparing an HCP for its Green River water supply operation and watershed protection, and is the local sponsor of the AWSP.

The Plum Creek Timber Company's HCP amendment (USDI 1998b) added the Columbia River DPS of bull trout to their HCP. The amendment allowed for the take of bull trout associated with habitat degradation/loss due to 150 acres of selective and thinning/restoration-oriented silvicultural harvest per year, 2 miles of stream restoration per year, and 20.2 miles of road construction, maintenance, and removal per year. The term of the Plum Creek HCP and permit is 50 to 100 years.

The WDNR's HCP amendment (USDI 1998c) to include bull trout allowed for incidental take of bull trout associated with habitat degradation/loss due to 29 miles of road construction and maintenance per year, and 158 acres of selective and thinning harvest per year. This amendment added only the Coastal/Puget Sound DPS of bull trout to the WDNR's HCP.

EFFECTS OF THE ACTION

Direct Effects

The primary adverse effects of the proposed action would result from: (1) the mobilization and release of accumulated fine sediment from the reservoir during flushing events; (2) the extended period of time that turbid water would be released due to the larger storage volume; (3) the release of fine sediments from the construction of the fish passage facility and implementation of the habitat improvement measures; (4) the withdrawal and storage of 20,000 acre-feet of water for Tacoma's municipal and industrial water supply; and (5) the withdrawal and storage of 25,400 acre-feet for flow augmentation purposes. We believe each of these factors could have an adverse effect on bull trout spawning, foraging, and rearing habitat.

The flushing of accumulated reservoir sediments poses the greatest risk to bull trout because of the large quantities of fine sediment involved and the expectation that the sediment releases would be repeated.

The PBA indicates that not all the reservoir sediments would need to be removed, but enough to create a channel to allow the future routing of sediments that enter the reservoir. The initial estimate, as presented in the PBA, is 236,000 cubic yards. Subsequent clarification by the Corps (F. Goetz 2000) indicates that the estimate should be considered an upper limit, and that the actual amount would likely be much lower. For the purposes of this BO, the USFWS assumes that up to 236,000 cubic yards of accumulated reservoir sediment could be mobilized and enter the river.

The flushing of reservoir sediments could lead to the deposition of fine sediment downstream of HHD at levels that are detrimental to bull trout. The impact to bull trout, however, would depend on their presence and use of the Green River mainstem during the periods of sediment flushing and on the adequacy of the flow releases to keep the fine sediments in suspension for

their transport to Puget Sound. The operation of HHD for flood control increases the potential for fine sediments to settle out in the hyporheic zone and adversely affect spawning habitat as well as the productivity of the river. Since the channel formation processes have been impacted by flood control and the interception of gravel and large woody debris by HHD, there are fewer opportunities for fine sediment to be flushed from the interstitial spaces of the channel bed in the unconfined reaches of the river. The PBA describes the framework for the development of the proposed sediment management plan, and a process which includes the Corps' annual coordination with the FWS and NMFS for determining whether the proposed procedures are 'allowable' under ESA protective measures. Depending on the quantity of fine sediment that would be flushed from the reservoir, the impact to bull trout could be minimal or severe. Since the PBA does not include a sediment management proposal with sufficient detail to evaluate, we have assumed for the purposes of this BO that the impact to bull trout from releases of reservoir sediment will be reduced to acceptable levels and that the Corps will be able to achieve its sediment management objectives within the limitations, (e.g., 25 percent increase in turbidity, compliance with federal and state water quality requirements, etc.) as described in the terms and conditions section, while the Corps completes its sediment analyses and develops its sediment management plan.

The release of turbid water from the reservoir will be prolonged due to the greater storage volume under the AWSP and the larger amount of reservoir shoreline and shallows exposed to wave action. The greater storage volume, however, would likely result in lower peak turbidity levels because of the effects of dilution.

The release of fine sediment resulting from the construction of the fish passage facility and the implementation of the habitat improvement measures are also a concern. Their effects, however, are expected to be minor in comparison to the flushing of reservoir sediments because of the much smaller quantities, their less frequent occurrence, and the greater ability to control the entry of sediments into the river through the implementation of best management practices. With regard to the gravel augmentation element, we do not concur with the use of "pit run gravel" because of the potential for it to contain an unacceptably high percentage of fine sediments.

The introduction of sediment in excess of natural amounts can have multiple adverse effects on channel conditions and processes resulting in effects on bull trout survival, the food web, and water quality conditions, such as water temperature and dissolved oxygen level (Rhodes *et al.* 1994). Fine sediments can influence incubation survival and emergence success (Weaver and White 1985) but may also limit access to substrate interstices that are important cover during rearing and overwintering (Goetz 1994; Jakober 1995). Emergence success of bull trout has been shown to be approximately 80 percent when no fine materials are present, and approximately 30 percent when 35 percent fine materials are present (Weaver and White 1985 in Montana Bull Trout Scientific Group 1998). Bull trout at all life stages occupy deep pools and few bull trout are found in streams where pools are lacking (Dambacher *et al.* 1992; Buckman *et al.* 1992 and Goetz 1989 in MBTSG 1998). Shifts in sediment loads set off a complex of channel responses including changes in pool volumes, depth and frequency, and changes channel morphology

(including slope, sinuosity, shape, velocity, flooding regime, and sediment transport) (Rhodes *et al.* 1994; Castro and Reckendorf 1995).

Even though the AWSP includes provisions (e.g., target base flows and the use of an adaptive management approach for reservoir refill) to reduce the impact of storing and removing an additional 100 cubic feet per second of water from the Green River, the timing, magnitude, and duration of the connectivity of side channel habitats with the mainstem Green River will be altered. As a result of the elimination of flows exceeding bankfull (i.e., 12,000 cubic feet per second at Auburn), as well as the interruption of the large woody debris and sediment transport processes, fewer side channels are being formed, and many of the existing side channels are now perched and are only accessible at the higher spring flows (Madsen and Hilgert 1997). The withdrawal of additional water from the Green River would reduce the amount and accessibility of wetted side channel habitat and could negatively impact bull trout foraging and rearing.

The storage of 25,400 acre-feet of water during the late winter and spring for flow augmentation purposes during the summer and early fall could reduce the availability of side channel habitats during the spring refill period. However, we believe the benefits far outweigh the potential adverse effects of storage because of the severe low flow conditions and higher water temperatures that would occur in the mainstem Green River without flow augmentation during the summer.

The Corps proposes to reduce the potential impact to side channel connectivity through monitoring and by adaptively managing the reservoir refill rate and provide higher baseflows. According to the PBA, the use of construction funds for project monitoring is available for only the first ten years, which is the limit of the Corps' official commitment. The USFWS believes monitoring is an essential part of the Corps' proposed adaptive management approach to reservoir refill and storage and should be treated as an operations and maintenance activity similar to the other actions the Corps conducts to fulfill its project obligations and responsibilities.

The habitat improvement elements of the AWSP, including the installation of fish passage facilities at HHD, the addition of large woody debris and spawning gravel downstream of HHD, the reconnection of side channels, the planting of emergent vegetation along the upper elevation of the conservation pool, riparian plantings, the adoption of an adaptive management approach for reservoir refill and flow augmentation, would improve habitat (spawning, rearing, foraging and migration) for bull trout, both in the near and long term. The HHD fish passage facility together with the fish facility Tacoma will be constructing at its diversion dam would provide access to more than 100 miles of mainstem and tributary habitat. We believe some of this habitat is presently suitable for bull trout spawning, rearing or foraging, and would increase in the future if the upper basin recovers from the effects of logging. The addition of gravel would improve conditions for spawning in the armored sections of the Green River downstream of HHD between river mile 42 and river mile 61. The addition of large woody debris below HHD could contribute to the formation and deepening of pools and benefit bull trout by improving rearing,

holding and foraging habitat. Riparian plantings would benefit bull trout by reducing water temperatures, and by increasing the productivity of the aquatic system through the cycling of nutrients, production of detritus, and contribution of insects. The option to store an additional 5,000 acre-feet of water for flow augmentation purposes could benefit bull trout during dry periods.

Indirect Effects

The AWSP would have both positive and negative indirect effects. On the beneficial side, the addition of large woody debris and coarse sediments downstream of HHD and the riparian zone plantings would help in the partial restoration of the channel forming processes that have been affected by the original project and other developments within the channel migration zone. Over time, these measures should result in greater channel complexity and habitat diversity than presently exists. In addition, if the habitat improvement measures result in greater numbers of salmon, steelhead and other fish species, above and below HHD, bull trout would benefit from the additional prey base.

On the negative side, the expansion of Tacoma's municipal and industrial water supply facilitates the continued growth and development within the area. As a result, bull trout habitat along the Green River and its tributaries will continue to be at risk from residential and industrial development, increased runoff from additional impervious surfaces, and from actions related to flood control.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Three broad categories of cumulative effects which may occur in the action area include: (1) growth and development; (2) forest management; and, (3) other management actions. Growth and development refer to permanent loss of suitable habitats. Growth and development actions include conversion of forest habitat to urban, other residential, commercial, or agricultural uses, and for structures or networks providing infrastructure support such as hydro power and irrigation diversions, roads, and power-lines. Forest management refers to temporal and spatial changes from other State or private actions in suitable habitats across the landscape in the action area. Examples include age or structural changes resulting from harvest and other forest-management actions such as planting, pruning, fertilizing, forest growth, and wildland fires. Other management actions refer to actions within suitable habitats which impact habitat structures or composition such as recreation, grazing, fishing, and mining. Each of these categories of impacts may result in the loss of secure habitat for species using suitable habitats

within the action area. Examples of this include physical displacement, exposure to contaminants, and declining air and water quality.

CONCLUSIONS

After reviewing the current status of the bull trout, the environmental baseline for the action area, the effects of HHD, the proposed AWSP and the cumulative effects, it is the USFWS' biological opinion that the continued operation of HHD and the proposed AWSP, as described in the PBA, are not likely to jeopardize the continued existence of the bull trout. No critical habitat has been designated for this species, therefore, none will be affected.

It is expected that adverse effects to bull trout and their habitat from the project will be moderate and that over the long term will be offset by the habitat improvement measures that are included as part of the proposed action. Although the proposed plan to manage the accumulation of reservoir sediments lacks detail, we believe the potential impacts to bull trout will be reduced to acceptable levels if the Corps complies with all applicable state and federal water quality requirements. While some sediment may be introduced to the stream during construction, best management measures will be implemented to minimize impacts to bull trout and downstream habitat. Although the storage and removal of up to 20,000 acre-feet of water from the Green River for Tacoma's municipal and industrial water supply and the storage of up to 5,000 acre-feet for flow augmentation purposes are expected to reduce the quantity and accessibility of side channel habitat, the impact can be reduced to minor or moderate levels by adaptively managing the timing and rate of water storage. For these reasons, we conclude the effects of the proposed action are not likely to jeopardize the bull trout.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by Fish and Wildlife Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by FWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require its contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or its contractor must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The USFWS anticipates that incidental take of the bull trout will be difficult to detect and quantify. While bull trout may be harmed, harassed or killed as a result of the effects previously described, quantifying these effects are difficult. Therefore, even though the USFWS expects incidental take to occur, data are not available and are not sufficient to enable the USFWS to estimate a specific amount of incidental take to the species itself. However, the take of bull trout inhabiting approximately two miles of side channel habitat and sixty-four miles of the Green/Duwamish River mainstem from HHD to its entry into Elliott Bay can be anticipated.

EFFECT OF THE TAKE

In the accompanying biological opinion, the USFWS determined that this level of anticipated take is not likely to result in jeopardy to bull trout.

REASONABLE AND PRUDENT MEASURES

The USFWS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of bull trout:

1. Minimize potential degradation of water quality from the removal of accumulated sediments from the reservoir by flushing or suction dredging.
2. Minimize effects to bull trout from AWSP construction activities.
3. Minimize effects to bull trout from water storage withdrawal.
4. Monitor and evaluate the effectiveness of the gravel and large woody debris supplementation programs.
5. Monitor and evaluate the effectiveness of the remaining project elements.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The following terms and conditions are necessary for the implementation of RPM 1.

During the period prior to the completion on an acceptable sediment management plan, if the Corps operates Howard Hanson reservoir in a manner to mobilize and flush accumulated sediments from the reservoir, the Corps must comply with conditions 1 through 4.

1. The flushing or dredging of accumulated sediments from Howard Hanson Reservoir will be limited to the period, December through February when inflows to the reservoir exceed 4,000 cubic feet per second. Sediment flushing shall cease when inflows recede to less than 4,000.
2. Sediment removal must be initiated only on the rising limb of the hydrograph, i.e., increasing inflows to the reservoir.
3. All applicable state and federal water quality requirements must be met. In addition, the increase in turbidity resulting from the removal of reservoir sediments by flushing or dredging must not exceed 25%. Turbidity levels will be measured at the Green River upstream of its entry to Howard Hanson Reservoir and at the intake to Tacoma's diversion dam for determination of the turbidity level change. Turbidity measurements will be taken every hour when sediment flushing is occurring.
4. The Corps will evaluate the effect of sediment flushing on the deposition of fines within the substrate at downstream locations to be determined jointly by the USFWS and the Corps.
5. The Corps will follow through with its commitment to develop a sediment management plan that is acceptable to the USFWS within two years from the date of this BO.
6. The Corps will meet with the USFWS on its sediment management activities when the development of its sediment management plan is completed.
7. The USFWS must approve the sediment management plan for the reservoir before it is implemented.

The following terms and conditions are required to implement RPM 2:

1. An Erosion and Sediment Control Plan shall be developed and in place prior to the construction of the AWSP. All reasonable measures for the prevention of erosion shall be

included in the plan to eliminate sediment input into the Green River or its tributaries in the short and long term. The plan will be fully implemented.

2. All terms, conditions and provisions of the Hydraulic Project Approval will be fully implemented.
3. All activities within the active channel or at locations which could contribute sediments or toxic materials to the Green River or its tributaries will be completed within the in-water work period, as defined in the WDFW's HPA for the AWSP.
4. A spill prevention and control plan will be in place prior to beginning the project. Hazardous materials must be handled in such a way that minimizes the risk to aquatic and riparian habitats.
5. The Corps will meet with the FWS annually during the project construction phase in order to determine if the project elements, scheduled for construction or implementation within the following 12 month period, still fall within the scope of the PBA and coverage of this BO.

The following terms and conditions are required to implement RPM 3.

1. The Corps will implement an adaptive management approach to the storage of water to reduce the potential impacts to bull trout or their prey species by maintaining the connectivity of side channel habitats and providing suitable out-migration flows, both through the reservoir and downstream of HHD.
2. The effects of the project will be monitored so that storage of water for the AWSP can be adaptively managed to reflect the dynamic relationship between the biological community and their physical habitat and to minimize impacts to bull trout and their prey resources. If the first ten years of project monitoring do not produce sufficient information on which to base future adaptive management decisions, the Corps will extend its monitoring commitment and obtain or fund by itself or with the assistance of Tacoma (local sponsor of the AWSP) the requisite information to make biologically based decisions on reservoir refill. The information that will be needed to make these decisions include side channel connectivity, out-migration timing and survival (through the reservoir, fish passage facility, and lower river), and the flow level needed to avoid fish stranding and the dewatering of redds.

The following terms and conditions are required to implement RPM 4:

1. Spawning gravel will be within the sediment size range (12.7 mm. To 101.6 mm.) and composition that is recommended in the AWSP feasibility report and environmental impact statement (appendix F, section 4b, table 1), unless the Corps demonstrates to the USFWS' satisfaction that an alternative size range or size distribution would be of greater benefit to bull trout or their prey resources.

2. The physical and biological responses to the gravel supplementation program will be monitored.
3. The effectiveness of AWSP gravel supplementation program will be evaluated and will address whether the amount of gravel from the HHD and AWSP actions, in combination with other gravel supplementation effort, i.e., Green/Duwamish Basin Restoration Program, are sufficient to arrest the continued armoring of the streambed, restore degraded spawning habitat, and facilitate the formation and/or the reconnection of side channel habitats.
4. The physical and biological responses to the large woody debris supplementation program will be monitored.
5. The effectiveness of large woody debris supplementation program will be evaluated and address whether the transport of fifty percent of the large woody debris entering Howard Hanson Reservoir is sufficient to improve channel complexity and habitat diversity to a satisfactory level.

The following terms and conditions are required to implement RPM5:

1. The Corps will follow through with its commitment to develop a detailed monitoring plan to evaluate the effectiveness of the fish passage facility, the adaptive management approach to reservoir refill and to determine whether project modifications are necessary. The monitoring plan must be acceptable to the USFWS and completed within two years from the date of this BO.

In order to monitor the impacts of implementation of the reasonable and prudent measures, the Corps shall prepare a report describing the progress of the proposed AWSP, including implementation of the associated terms and conditions, and impacts to the bull trout (50 CFR Sec. 402.14(i)(3)). The report shall be submitted to the Western Washington Office annually through the completion time for the proposed actions, and shall be submitted no later than April 1 for the preceding 12-month period ending December 31. The report shall list and describe:

1. Adverse effects resulting from the implementation of the proposed AWSP;
2. When and if the level of anticipated incidental take is approached;
3. When and if the level of anticipated incidental take is exceeded; and,
4. The effectiveness of the terms and conditions.

In addition, the USFWS is to be notified within three (3) working days upon locating a dead, injured, or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological

materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact our Law Enforcement office at (206) 883-8122 or our Western Washington Office at (360) 753-9440.

The USFWS believes that bull trout associated with no more than sixty-four miles of the Green/Duwamish River downstream from HHD and about 2 miles of side channel habitat will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Conduct pre-project snorkel surveys for bull trout.
2. Conduct research to better define population status and use by bull trout of watersheds affected by Corps activities.

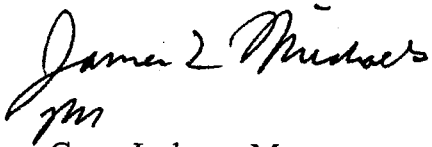
In order for the USFWS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the USFWS requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed

or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Sincerely,

A handwritten signature in black ink, appearing to read "Gerry Jackson". The signature is fluid and cursive, with a large initial "G" and a stylized "J".

Gerry Jackson, Manager
Western Washington Office

c: Tacoma Public Utilities

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